

acorns. Both these oaks are usually grown isolated in vineyards for their cork. *Quercus Tozza* is restricted to the south-west of France, where extensive coppices of it are grown for fuel. Hornbeam is abundant in the north-east, chiefly in coppice-with-standards; its abundance in Epping Forest probably dates from the time when England was connected by land with the Continent. Other species of forest trees, such as ash, alder, sweet-chestnut, sycamore, willows, poplars, birch, lime, elms, &c., are either confined to special soils over small areas, or disseminated in forests of the principal species that have been already mentioned. Maps are given in the text-book showing the geographical distribution of the principal trees.

There is an excellent chapter on the action of trees on one another, and on the value of shade-bearing species, such as beech, as auxiliaries to the more valuable light-demanding trees, such as the pedunculate and sessile oaks, the former being chiefly grown in the lowlands on deep, moist or even wet soils, as standards over coppice, and the latter with beech in high forests on the hills. Both these oaks, as well as the holm oak, are also extensively grown in coppice woods, chiefly for their bark, as tanning material.

A good account is given of the nature of forest soil, and the necessity of preserving the dead leaves to form humus is strongly insisted on. It has been proved by Grandeau and Henry, two of the Nancy professors, that besides serving as food for earthworms and other organisms, the activity of which keeps the soil porous, friable and superficially rich in nutritive mineral matter, dead leaves fix atmospheric nitrogen to the extent of 12-20 lbs. per acre annually. To deprive the forest of its dead leaves is like robbing a farm of its dung.

The evolution of a crop of trees by natural regeneration is well described, the account of coppice-with-standards being probably more complete than in any other text-book. The cultural methods to be followed when once the new crop is established are also well explained and chiefly consist of cleanings and thinnings. The authors are strongly opposed to the pruning of forest trees, and consider that drainage is very rarely required. Their remarks on these points should be read. Among sylvicultural systems yielding even-aged high forest (*futaie régulière*), the clear-cutting system (*procédé par coupe unique*), which is so extensively followed in parts of Germany for crops of spruce or red pine, is employed in France only for maritime and Aleppo pines. The cones of the pine trees adjoining a clearing produce abundance of seed, which at once stock the ground, provided the felled material is rapidly removed, and the seedlings of these trees are so vigorous and hardy against drought, that they soon dominate the mass of bushes and weeds springing up around them.

The system under which a mature crop is gradually removed (*procédé par coupe successive*), termed by Dr. Schlich shelter-wood compartment system, is that commonly employed in French high forests. It gives admirable results in oak and beech woods, but its application to silver-fir is not so successful, as silver-fir grows better when the larger trees are surrounded by an irregular undergrowth of beech and silver-fir.

The selection system (*jardinage*) similar to that em-

ployed in the Chiltern Hills for beech, is much used in France for silver-fir, chiefly in communal and private forests, and in State forests in mountainous districts, where it affords the best protection against denudation of the slopes.

About 70 pages of the book are devoted to an account of possible injuries to the forest by men, animals, plants and meteoric influences. This really constitutes the subject of Forest Protection, and is usually dealt with apart from sylviculture in German and English forestry text-books. One hundred and sixty pages at the end of the book treats of artificial reproduction, and resemble the account of sowing and planting usually given in other good sylvicultural works. This part of the book terminates with an account of exotic trees, the introduction of which is not viewed in France with nearly so much interest as with us, although the subject is very judiciously treated in the present volume.

The book is profusely illustrated by reproductions of photographs chiefly taken by Nancy students during their summer tour; it forms a highly valuable contribution to forestry literature, and is certainly the best account of French sylviculture that has yet appeared. There is a good table of contents, but no index, the omission of which is to be regretted.

W. R. FISHER.

TOPOGRAPHIC SURVEYING.

Topographic Surveying. By Herbert M. Wilson. Pp. 884. (New York: Wiley and Sons. London: Chapman and Hall, 1900.)

M R. WILSON'S book is comprehensive, clear and well illustrated, and contains much information of practical use to the surveyor and explorer, which is not usually found in works on surveying and map-making. Its author is a member of the staff of the United States Geological Survey, and his remarks on the methods and processes of that Survey are therefore of special interest.

The Geological—which is virtually a topographical—Survey of the United States is a work of great magnitude, and the manner in which the staff engaged upon it have met the numerous technical, transport and other difficulties that have arisen during its progress is most interesting. It was laid down as a general principle that no part of the country should be surveyed in greater detail, or at greater cost, than was necessary for the purposes which the resultant map was intended to subserve. This involved a rapid and economical survey of a vast extent of country within reasonable limits of error. The method adopted

“consists of a combination of trigonometric, traverse and hypsometric surveying to supply the controlling skeleton, supplemented by the ‘sketching in’ of contour lines and details by a trained topographer. In this method the contour lines are never actually run out, nor is the country actually cross-sectioned.”

The instruments used vary with the nature of the country. For geodetic work, a combination transit and zenith telescope of special pattern (p. 726) has been found most convenient. Primary bases are measured with steel tapes, with an average probable error of 1/300,000, in from seven to ten days, at a cost of 20*l.* to 40*l.*; whilst the bases of the U.S. Coast and Geodetical Survey have

a probable error of 1/1,000,000 to 1/1,500,000, take from two to six months to measure, and cost from 500*l.* to 2600*l.* The observations for the primary triangulation are made with an 8-inch direction theodolite, the average rate and cost being six stations per month and 3*s.* 7*d.* per square mile, and the average probable error of the triangulation 1/40,000. The averages of the Geodetic Survey are three-fourths of a station per month, from £2 to £6 per square mile and the probable error 1/150,000. For filling in the detail the essential instruments are the plane-table and telescopic alidade (p. 156). The horizontal distances are obtained, according to circumstances, by triangulation with the plane-table, by stadia and odometer measurements, by chaining, and by pacing. The altitudes are dependent upon primary lines of levels run with a precise spirit-level (p. 328), and having a probable error in feet = $\cdot 02 \sqrt{\text{distance in miles}}$; on angles of elevation and depression at the principal trigonometrical stations, on secondary lines of spirit-levels and on aneroid observations. The topographical features are represented on the map by contour lines sketched by eye with the assistance of an aneroid, and great importance is attached to the quality of the sketching. This depends upon the artistic and practical skill of the topographer, or upon his ability to make correct generalisations, and decide upon the amount of detail which should be omitted or preserved so as to bring out, on the selected scale, the predominant features of the country surveyed. In this work, as the author justly remarks, great proficiency "can only be attained after years of experience." He also rightly holds that the topographer should have a sufficient knowledge of geology and physiography, or of the "origin and development of topographic forms," to enable him to appreciate the features which he is sketching and to represent them intelligently on his sketch.

Mr. Wilson's book is, however, very far from being a simple manual for the use of the Geological Survey. It deals with every description of survey, and treats each fully. Part i. contains much useful information on the different classes of survey. An interesting description is given of the survey of Baltimore on a scale of 1:2400, which corresponds nearly to the 25-inch scale of the Ordnance Survey; but if the figures given in the table, p. 107 (Baltimore 814*l.* per square mile, Ordnance Survey 59*l.*), are correct, the cost would be considered prohibitive in this country. The remarks on geographic and exploratory surveys are good, and Mr. Johnson's excellent plane-table sketch, which is given as a specimen of an exploratory survey (p. 91), may well serve as a model for sketchers. Military surveys are correctly defined as having for their object "the representation of the natural and artificial features of the country with the maximum exactitude consistent with the greatest rapidity of execution." The concluding chapter is a well illustrated memoir on the relations of geology to topography, and on 'earth sculpture,' or the constructive and destructive processes by which existing topographical features have been formed. The importance of a knowledge of these subjects to the topographer and cartographer is clearly pointed out. A valuable addition to the chapter is a glossary of all geographical and topographical descriptive terms in common use in

the United States, which, pending the compilation of a similar list for the United Kingdom, will be found useful in this country.

In Part ii. the instruments and methods employed in the measurement of horizontal distances and in plane surveying are clearly described and explained. Chapters vii. and viii. on plane-tables and alidades, and chapters xii. and xiii. on stadia and angular tachymetry, deserve the attention of surveyors in England, where stadia measurements, which give results over rough ground as good as those with the chain, are little known. In another chapter the author describes photo-surveying methods, which are much in favour in Canada, and points out their limitations and the conditions under which they can be advantageously employed. Part iii. deals with instruments and methods for the determination of altitudes. The American spirit levels and levelling staves are of better pattern than those in use on our Ordnance Survey, and the accuracy of the principal lines of levels is greater than that of the similar lines in Great Britain. In Part iv. the author explains the various kinds of map projections, the methods of representing hill features and the construction of relief maps. He very rightly lays down that the cartographer should be "possessed of such actual knowledge of map-making as is only gained by practical experience in field-surveying," and that the topographer should have a general knowledge of projections and map construction. The difference between the principal methods of representing ground is well brought out; that by hachures is happily characterised as "a graphic system with a conventional element," and that by contours at close intervals as "a conventional system with a graphic element." Wax and clay mixed with glycerine are considered the best materials for modelling, and it is pointed out that a modeller should have a good knowledge of topography. Parts v. and vi., "Terrestrial Geodesy" and "Geodetic Astronomy," are clearly written and well supplied with tables; and the latter contains a chapter on "Photographic Longitudes." In Part vii. the surveyor in unsettled country will find many excellent hints as to camp stores and equipment, pack transport, medicines, clothing and photography.

In conclusion, it may be added that the book contains 884 pages, 62 tables of various kinds, 205 excellent illustrations, and a most useful index. It would in some respects have been more convenient if it had been published in two volumes. C. W. W.

THE ETHNOGRAPHY OF BRITISH COLUMBIA.

Memoirs of the American Museum of Natural History. Vol. II. *Anthropology.* i. *The Jesup North Pacific Expedition.* iv. *The Thompson Indians of British Columbia.* By James Teit. Edited by Franz Boas. (1900.)

IMPORTANT results were looked for from the Jesup North Pacific Expedition, and the realisation has not belied the expectation. Thanks to the intimate knowledge of Mr. James Teit of their language, customs and beliefs, we now have a remarkably detailed and complete description of the Upper and Lower Thompson